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Editorial

The Magazine Committee's faith in the Radio Trade has been justified.

Six months ago the Committee took the big step of switching from the roneod magazine to the present printed one. They realised that for a while the Magazine would be produced at a loss—a fact which was borne out by the first five months of publication. However, the tide has now turned, and the future is very bright, for from month to month the magazine will gradually contain more pages.

This is a direct result of the realisation of the Radio Manufacturers, Wholesalers, and Retailers that "Amateur Radio" offers an excellent advertising medium.

It is up to you—the reader—to carry on the good work. You can do this by supporting the firms who are advertising in the magazine.

At the time that the P.M.G. Department issued the frequencies that would immediately be available for Amateur occupation, we were told that the first of the lower frequency bands to be released would be 3.5 megacycles, in about three months time.

As the New Zealand Amateurs are already occupying the 3.5 megacycle band, Federal Headquarters requested some six weeks ago, the immediate release of this band.

It is confidently anticipated that the authorities will not forget their promise of the release of this band, and the higher frequency bands.

IN THIS ISSUE

RECTIFIERS

By F. P. DICKSON (VK2FB)*

PART 1
HIGH VACUUM RECTIFIERS

Rectifiers are used in enormous quantities and in a variety of types, but, while many amateurs are familiar with both theoretical and practical sides of their operation, there are many who have not had the opportunity to go very deeply into the subject. The writer has done a good deal of work in the last few years on the development and production of rectifiers, and with the feeling that both newcomers and old hands will find something of use and interest in the knowledge so gained, the following article has been written, particularly for the benefit of those who are just making their start in amateur radio.

Although the principles are the same we will confine ourselves to power rectifiers and not deal with those used for the detection of high frequency signals. We will further confine ourselves to hot cathode rectifiers of two kinds, high vacuum and gas-filled.

High vacuum rectifiers are among the simplest of valves, but not necessarily the easiest to make. Fundamentally, we have a hot cathode which may be directly heated in the form of a filament, or indirectly heated, and an anode which are mounted a suitable distance apart in an evacuated bulb. In practice, this vacuum is not perfect, nor is perfection even theoretically necessary, all that is required being that on the average, electrons moving from cathode to anode shall not come into collision with gas molecules. The distance which the average electron can travel without collision is called the "mean free path" and is a measure of the suitability of various degrees of vacuum for the purpose in view. In commercial H.V. rectifiers this distance is of the order of ten miles, so that there need be little fear of obstruction by the residual gas.

The cathode is heated to a sufficient temperature to cause electrons to be freed from its surface ,and they form a kind of cloud around it, known as the space charge. The quantity of electrons in the space charge is limited by the cathode temperature, as the electric field set up by them tends to repel other electrons escaping from the cathode. Some electrons from the space charge drift away, for they are all in a state of violent motion and those not obstructed by other electrons will inevitably move away from the space charge. If the anode be connected to the cathode via a current indicator it will collect some of these electrons and a small current will be observed. This is the Edison effect. If we now make the anode positive with respect to cathode electrons are attracted to it along its electric field and their random motion is given a general direction. As the anode voltage rises more electrons are attracted and arrive with greater velocities, both of which factors cause heating of the anode.

The field of the space charge is opposite in sign to that of the anode and largely neutralises it in the vicinity of the cathode so that only a portion of the applied anode voltage is effective in drawing over electrons. This is the reason for the considerable internal resistance of high vacuum rectifiers and accounts for the relatively high voltage drop. A very high voltage would be required to draw away all the electrons which the cathode will emit. When testing the emission an arbitrary convenient voltage is chosen and the saturation current then flowing, which is described as "space charge limited," is a satisfactory indication of what the cathode is capable of emitting.

The vast majority of rectifiers used by amateurs have oxide coated cathodes, the oxide being a mixture of barium and strontium oxides. These materials have exceedingly high emission as the comparative table (1) below reveals.

Material	Saturation Current in A/Cm² at at 1000°K	Temperature for 1 A/Cm² Saturation
Tungsten	1.3 x 10^{15}	2635°K
Thoriated Tungsten	5.5 x 10^{5}	1475°K
Barium Oxide	1.1 x 10^{1}	960°K

(Degrees K are degrees C reckoned from absolute zero—273°C.)

Operating as they do at relatively low temperatures, oxide cathodes which depend for their emission on a monatomic layer of metallic barium, or any one of a vast number of substances which can settle on the cathode and not be vapourised off at the operating temperature, will destroy the emission. The metallic barium diffuses through the coating to form the actual emitter, and failure of emission is ultimately brought about by progressive poisoning, by sintering (hardening of the coating with heat) and electrolysis which makes chemical changes. The effect of all these is that the layer can no longer be renewed. There is also a slight but continual evaporation of the material.

We noted that as the voltage and current are raised the temperature of the anode increases. If continued far enough a stage may be reached at which the anode itself is hot enough to have appreciable emission, particularly if some cathode material has settled on its surface.

When this happens the anode emits when it goes negative and electrons from it strike the cathode and raise its temperature, increasing its emission. This is a cumulative effect and very soon the valve no longer rectifies, but passes A.C. The whole valve is grossly overheated and gas is released which may have disastrous effects. The gas ionises, the ions neutralise the space charge and greatly increased currents flow until the valve is destroyed.

In practice, the anode is made of material or coated with substances having a high "work function" which means that it is difficult to dislodge electrons from them. One of the best of these is carbon, which is also an excellent radiator of heat, helping both ways.

If we can reduce the internal resistance of the valve we can draw much larger currents without danger because due to lower voltage drop the electron velocities and the heating are smaller. This can be done by bringing the anode closer to the cathode, and valves of this kind now on the market have anode to cathode spacing of 15 to 20 thousandths of an inch for 400 volts or so. In a good vacuum there is no risk of the anode voltage sparking across this gap, but we are faced with a different and much more difficult set of conditions. All such valves are indirectly heated as it would be impracticable to use a filament in such small spacing. A longer useful cathode area can also be used for the same heating power. The curves of voltage drop against current show clearly how the internal resistance is reduced by close spacing. Both valves use the same heating power.

*Transmitting Valve Department
Philips Electrical Industries of Australia.

(1) Ref. J. G. W. Mulder, "Development of Hot Cathode Rectifiers."

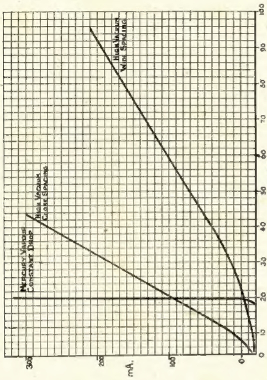


FIG. 1

In these close spaced valves any small projections on the surfaces are dangerous causes of local overheating and great care must be taken with the anode to prevent back emission. The cathode also calls for special treatment; the coating is made very fine and dense with a smooth surface, all of which factors tend to give lower emission. However, as the space charge limitation is not so severe due to proximity of the anode, and special pumping treatments are used, the emission is still entirely adequate.

We are now in a position to consider rectifiers in operation and as we are concerned with valves we will only mention the filtering arrangements insofar as they directly affect the valve. When the anode is fed with A.C. current is passed on the positive half cycles, rising and falling with the voltage above the zero line. At the crest of the cycle the peak voltage, 2 times the R.M.S. value, is distributed as voltage drop in the valve and in the load connected with it—Fig. 2 (a). As a filter normally contains some capacity and inductance its voltage does not fall instantly to zero but is still considerable when the anode is at its negative peak. As the valve is no longer conducting a large voltage appears across its elements, the transformer peak voltage, plus that remaining in the load circuit, as in Fig. 2 (b). The figures quoted are quite arbitrary, but entirely possible.

The peak inverse voltage across a rectifier is an important limit and exceeding it is asking for trouble, which will come, especially in close spaced valves, in the form of an arc-over. In those vaves we have an extremely concentrated field due to the high inverse voltage across the small spacing. Any back emission, or if there are enough of them, gas ions bombarding the cathode will start an arc which, if not suppressed by fuses will destroy the tube.

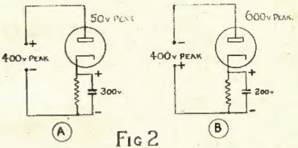


Fig 2

Arc-overs in close spaced tubes do not occur on the forward half cycle because of the low voltage drop, except when the valve is warming up. The cathode is then only partially heated, its emission is low and the voltage drop proportionately great. Under these conditions arcs may and frequently do occur, but usually they only damage a small portion of the cathode. A cathode which has suffered a bad arc-over shows a large patch where the coating is entirely removed, and perhaps even a hole burnt through the sleeve. Surrounding the bare patch is a large discoloured area from which there is no emission due to poisoning of the surface. Apart from this damage sufficient gas is frequently released to make the valve completely useless.

Let us now consider a rectifier with a condenser input filter. The condenser voltage rises with the anode voltage ,but does not fall to zero with it as it takes time for the charge to be dissipated in the load circuit. None the less the charging current is fairly heavy, increasing with higher condenser capacity and lower load resistance. At very light loads this condenser tends to remain charged to the peak voltage applied to the rectifier but falls rapidly as the load increases.

In practical operation the peak current may be many times the average current if the condenser is large, and this is another limit which must be observed if long valve life is desired. Without an oscillograph it is not easy to measure peak currents, but if the manufacturers' ratings are followed no trouble need be feared.

With choke input the surges of current into the condenser are limited by the impedance of the choke and the peak current is not much greater than the average value, while the voltage tends more to the R.M.S. than the peak value. The regulation is very much better; that is, there is less change of output voltage with load resistance, and the valve has a more favourable operating condition.

So far we have dealt with half wave rectifiers only. The full wave tube has two anodes working alternately. The condenser, whether preceded by a choke or not, has less chance to lose its charge so that the output voltage varies less over the A.C. cycle and the peak currents in the valve are proportionately lower.

In order to keep the peak plate currents of low impedance rectifiers within the makers' ratings, the circuit impedances specified should be strictly adhered to and the transformer impedance made up with resistors if it is insufficient.

When more current than one valve will handle is needed, rectifiers can be paralleled. Valves of high or medium impedance can be directly paralleled and the internal resistance will look after the differences of emission and plate current. The low impedance close spaced valves, however, are another matter. As seen in Fig. 1, two or three volts difference in tube drop make a very large difference in current and in the absence of limiting impedances one valve or one side of a valve may be greatly overloaded. Evening out of the currents can

(Continued on Page 10)

DIRECT DISC RECORDING

PART 1
INTRODUCTION

(Based on a series of Lectures delivered by Messrs. R. N. Kinley and L. T. Garrioch to the Sound Recording Institute of Australia, Melbourne).

FOREWORD.

The technique of recording sound waves on various media so that they may later be re-produced at will, finds many applications in our present day mode of life. One has only to consider the use made by the Broadcasting and Motion Picture Industries of this process to realise how large a part it plays in our individual existences, to say nothing of the huge fraternity of music lovers throughout the world who possess a gramaphone with which to bring the works of the masters into their own homes.

There are several ways in which sound recording may be carried out, and each has its own particular application. They differ widely in their choice of medium in which to enshrine the sounds, and in their method of so doing. Thus we find the motion picture industry using a photographic method of registering various patterns on the side of their film, which when passed through suitable equipment will cause the re-production of sounds bearing a close resemblance to the dialogue which was originally associated with the action being displayed on the screen. One of the most recent methods adopted by broadcasting is the use of a metallic tape or wire into which varying magnetic conditions are injected according to the nature of the sound waves being recorded. When the wire or tape is re-run through appropriate equipment, these sounds are re-generated and bear a considerable resemblance to the original.

A third method is to employ a disc or cylinder on which is engraved a shallow track of considerable length, the undulations of which are impressed according to the nature of the sounds being recorded. These are later used as a cam to produce mechanical motion of a needle ,and the subsequent production of sound waves. This method is historically the oldest of all, and despite the many claims put forward on behalf of other systems, it still retains certain advantages which are unique, and is therefore not likely to be readily displaced. It is with this method of recording that the following article will deal, having particular regard to the requirements of those who wish to undertake experimental work in this field.

SOUND-ON-DISC RECORDS.

The Gramaphone is such a familiar piece of equipment to-day that no attempt will be made to describe how it works, beyond indicating a few facts which might not readily be apparent. As mentioned above, the undulating channel which constitutes the sound track acts as a cam to import motion to a needle which in turn generates sound waves by either mechanical or electrical means. The undulations may take place from side to side, keeping the depth of the groove constant, or they may vary in depth only. The former method is termed "Lateral" Cutting, and the latter, "Vertical" Cutting. Certain advantages lie with Vertical Cutting, but the technique is very much more difficult, and for Amateur practice, Lateral methods are to be recommended. In either case, however, the dynamical conditions are similar ,and these will now be considered.

The motion given to the gramophone needle by the rotating disc is the foundation upon which the resulting sound waves will be built. The number of vibrations executed per second under the influence of the groove will determine the pitch of the resulting sound. The relative energy of the sound, however, will depend upon the **velocity** with which the needle is moved. In order to appreciate fully this particular fact, let us digress for a moment and consider a record on which has been impressed a pure tone of frequency 1000 cycles per second and amplitude (a) inches or cms. The groove will then have the appearance of Figure 1a, which is easily recognised as a sine wave, and its proportions will be such that at any given diameter, and when rotated at its correct speed, the time required for the length of track between points A and E to pass beneath the needle will be 0.001 seconds. During the passage of portion AB, the needle will have moved a distance (a) at right angles to to the axis AG of the curve. For portion BC it will move back a distance (a), and for portions CD, DE this process will be repeated on the opposite side of the axis AG. We thus see that the needle has moved a total distance of 4a during the passage of the portion AE of the groove ,and this has taken place in 0.001 seconds. The average needle velocity during this cycle is obtained by dividing the distance moved by the time, or 4a divided by 0.001, or 4000 a. This velocity may be specified in inches per second or in cms per second (usually the latter).

Now consider a similar 1000 cycle note of amplitude (a'), as shown in Fig 1b. By applying exactly the same reasoning, we find that the average needle velocity in this case will work out at 4000 a' inches (or cms) per second.

The interesting thing to note ,however, is that for any given frequency the needle velocity must increase proportionately to the amplitude of the groove. Experience or maybe intuition, tells us that louder sounds on a gramophone record must be associated with a larger amplitude, but the higher needle velocity which arises with louder sounds is a fact which is not normally called to mind when considering the probem.

In an electric pickup, the needle is connected to an armature which generates a small alternating electric voltage in a coil of wire. In an acoustic gramophone it is coupled to a diaphragm which sets up an alternating air pressure within the tone-arm and sound conduit. In both cases the effect depends upon the speed at which the needle moves. (This may be more readily appreciated by electrical devotees when it is remembered that the magnitude of the voltage induced in the pick-up coil is governed by the number of magnetic lines of force cut **per second**). Thus we see that the velocity of the needle is all important in the relative energy level which is produced in the pick-up, and is indeed a direct measure of the loudness of the resulting sound.

NOTE.—Critical readers will no doubt take issue with the authors over the use of this purely arithmetical average velocity. Mathematicians employ R.M.S. values for velocities in exactly the same way as electrical workers use R.M.S. values of voltages and currents, but the treatment of the subject in the above simplified form has been adopted for ease of explanation. In any case it makes no difference to the facts which we wish to elucidate.

This phenomenon is true for any one frequency, but when we come to consider different frequencies we meet another interesting fact, namely that sounds of equal loudness do not spring from grooves of equal amplitudes. In Figure 2 we see grooves for frequencies of 1000 and 2000 cycles per second which have been superimposed on each other for convenience. If they are to yield sounds of equal loudness, they must produce the same needle velocity ,and it will be evident that in order to do so they must have different amplitudes (a_1) and (a_2). A moment's consideration on the lines outlined above will show that amplitude (a_1) for the 1000 cycle groove will be exactly twice that for the 2000 cycle groove.

(Continued on Page 23)

CENTIMETER WAVE MAGNETRONS

THE TUBES THAT MADE MICRO-WAVE RADAR POSSIBLE

Taken from an article by Henry F. Argento in Q.S.T.

Although Radar has emerged from the war as a startling new discovery, its principles are not as new as they might appear to be at first hand. Radar was known and developed simultaneously in America, England, France and Germany during the early 1930's. Like every other electronic device, its development and improvement was predicated on the development and availability of tubes. The heart of any electronic device is a tube, whether it be a radio set, a Radar, or an electronic device.

Very early Radars were low frequency devices which used enormous dual ahtennnas and large bulky transmitters and receivers. It was known at the time that radars capable of greater resolution and accuracy, as well as much smaller and lighter in weight, could be developed if tubes could be made available to generate power at the super high frequencies. Accordingly, the British Admiralty assigned the problem of developing a generator of microwaves to a research group at the University of Birmingham. The Birmingham group developed a practical form of cavity magnetron which, along with other developments, opened the possibilities of obtaining satisfactory power output at extremely short wavelengths. In the latter part of 1940, a British technical mission headed by Sir Henry Tizard, demonstrated the cavity magnetron to American Scientists.

In the Autumn of 1940, Raytheon assigned its best research and engineering talent and facilities to work with the Massachusetts Institute of Technology in the making of experimental micro-wave type tubes. The art at that time was completely new—about as far advanced as radio was in the old spark gap days of 1916. The theory of generation of micro waves was not understood, equipment for experimentation was not available, and methods of producing useful tubes were unborn.

As is well known, Radar operates on the principle of sending out extremely short bursts or pulses of high frequency energy and measuring the time interval required for the small package of energy to reach its objective and to be reflected back to its source. When the length of time required for the energy to travel back and forth is known, the distance to the object can be accurately ascertained. By concentrating the energy into a very narrow ray, the beam can be used to scan different objects and the orientation of the beam antenna system or "Director" gives the direction. Thus the position as well as the distance of a given object can be gauged.

The two basic requirements for the generator are that it be capable of producing an extremely large amount of energy for short period of time, and that its frequency be as high as possible so that the narrowest possible beam can be produced with a given size of reflector in the radiating system. It is further required that the generated frequency be quite stable. The Magnetron is essentially a device which can be pulsed rapidly for intervals in order of micro seconds and which is capable of delivering hundreds, thousands and millions of watts of power at wave lengths in the centi-meter range.

MAGNETRON CONCTRUCTION.

To achieve frequencies, conventional ideas of tuned circuits containing lumped inductance and capacitance had to be discarded. Even the shortest lead lengths are too long to allow satisfactory operation at these frequencies. For this reason the circuits are built directly into the anode of the tube. Essentially, the Magnetron is the thick walled hollow cylinder of copper with a series of identical longitudinal "keyholes" in the wall around the inner diameter, the keyholes being cut so that the narrow slots open into the centre hole. Each of the keyholes represent a transmitter circuit, with the hole itself making up the inductance and the slot providing the capacity. Conventional oscillators use just one tank circuit, but in order to obtain workable sizes of tubes the Magnetron uses a series of multiple keyhole circuits all tuned to exactly the same frequency. In the centre of the cylinder is placed an emitting cylinder usually in the form of a nickel sleeve coated with active barium and strontium oxides which, upon being heated, produce a copious flow of electrons. Energy is removed from one of the cavities either by using a coupling loop or by having the cavity open into a wave guide window.

In the operation of the Magnetron a magnetic field is applied axially to the tube, causing the electrons to describe circular paths about the cathode when a high voltage pulse is applied between anode and cathode. The electron motion can be looked upon as air stream passing a slot, which, when the stream acquires the correct velocity, causes the cavity to resonate. The critical velocity of the electron stream is reached when one cavity represents a negative portion of the output wave while the next cavity is positive. The problem of the growth of oscillations is too complex to be adequately covered by such a simple anology, but space does not permit dealing with it more completely at the present time.

BUILDING THE TUBES.

The manufacture of Magnetrons is difficult, in as much as the tube requires a very high degree of vacuum, must be capable of delivering extremely high power at high voltage, and requires the utmost in mechanical precision in a metal—oxygen-free copper—which is very difficult to machine. The original magnetrons were made by taking a solid cylinder of copper and drilling, machining and broaching the desired configuration from the solid chunk. Approximately one hundred man hours of expert machine work were required to accomplish this, and the results were not always too satisfactory because for full efficiency each of the cavity resonators has to be the identical counterpart of its neighbour, moreover after being machined the tubes require hours of processing, ageing and testing. Their production was slow and costly.

Foreseeing the need for large quantities of microwave equipment the navy, in December of 1941, made funds available to Raytheon for the erection of a factory and the establishment of facilities for the production of micro-wave tubes. A building providing one hundred and twenty thousand feet of floor space was hurriedly erected. Equipment was designed, machines were ordered, and in May of 1942 Raytheon moved into this heavily guarded tube plant and produced the first magnetron in its new location. At the time these facilities were planned they were laid out for a maximum production of one hundred magnetrons per day. No sooner had the plant begun operating than the demand for the tubes increased from the hundred to the tens of thousands. Sufficient machine tool capacity did not appear to be available to meet this demand, and the magnetron loomed as the bottle neck item in the whole radar picture.

At this juncture, Percy L. Spencer, W1GBE, Raytheon Director of Research, developed a mass production system known as the "Lamination" Method, that eliminated precision machine work and over night expanded plant capacity from one hundred per day to over one thousand per day. In this method the desired anode configuration is stamped out in thin sheets of copper. Half of the cop-

per punching are discs having a diameter of about two inches, while the other half are stamped to a three inch diameter. The two sizes are stacked alternatively on precision jigs and then brazed together into one solid mass in an automatic conveyor furnace. In this way the entire magnetron body can be made without any precision machine work. Not only is the desired anode configuration achieved by this method, but the large laminations form the cooling radiator a swell, making it an integral part of the tube body. This has the effect of providing much better cooling. To supplement the lamination method, twenty foot diameter automatic exhaust machines were built, making it possible for one operator to do work formerly requiring fifteen in processing the tubes. All manufacturing was converted over to mass production technique, with magnetrons being produced on a series of a hundred and twenty foot production lines.

How well these methods worked is attested by the fact that magnetrons, the item which originally had been figured as a crucial bottle neck never once held up the manufacture or shipment of a piece of Radar equipment. Furthermore, these mass production methods were such that over half of all the magnetrons produced in the world flowed out of this one Raytheon plant.

VERSATILITY PLUS.

As the war progressed, different technical requirements dictated needs for different types of magnetrons. Special tubes were required to direct the guns of the big battle waggons, to search the skies for planes, to direct anti-aircraft searchlights, to track down fast flying buzz-bombs, to make light weight portable beacons, to direct precision bombing from the skies, and to land planes. The number and variety of tubes grew until there were fifty or sixty different types.

As usual, the first demand was for greater efficiency. Twenty per cent. was about the best that could be obtained with the earlier tubes. By designing for better ratios of inductance to capacity, and, principally, by discovering "Strapping," tube efficiencies were increased to well over fifty per cent.. The alternate solid sections between the cavities are electrically connected together. This forces alternate cavities to lock together to produce a single frequency, thus overcoming minor frequency differences between individual cavities.

The second requirement was for tunable magnetrons. At the rate new equipment was being designed, it looked as though there would have to be innumerable magnetron types if each one had to be a fixed frequency device. To meet this need, several different types of tuning mechanisms were developed at Raytheon. The one that has probably had the widest use in the field is that employed in the 2J61A. In this tube the small capacity ring is mounted above the anode block opposite the ends of the cavities. By varying the distance between the ring and the anode body the capacity of each individual oscillator is readily changed. Varying the spacing between the ring and block imposed a rather serious problem, in as much as mechanical motion had to be transmitted through a vacuum type body. It was solved by using a sterling silver diaphragm on one side of the anode and transmitting the motion to the capacity ring through this diaphragm.

In every piece of aircraft equipment weight and size are the dominating factors. Magnetrons require a strong external magnetic field, usually produced by a separate permanent magnet weighing anywhere from ten to forty pounds. To overcome this weight difficulty, the newer "package type" tubes were designed. In these tubes the air gap is reduced to a minimum by inserting the magnet pole pieces directly into the tube and by making the external magnet actually part of the tube. External magnet tube which previously had an overall weight of seventeen pounds were reduced in weight to three and a half pounds in the comparable package type —without sacrificing any efficiency or mechanical characteristics.

Characteristic of any new development the cry soon was for more and more power. The early tubes were capable of delivering powers of eighty to one hundred kilowatts. This was soon increased to two hundred, three hundred and five hundred kilowatt peaks. However, even these powers did not satisfy the services. They demanded peak powers of at least one million watts. It can be readily understood what a difficult problem was presented in as much as cathodes for such tubes had to be able to deliver one hundred amperes and the tubes had to be capable of operating at thirty thousand volts. Oxide coated cathodes able to met these requirements were unknown. Intensive work and considerable ingenuity were required to develop tubes to meet these specifications.

These figures may sound fantastic to those whose experience with power tubes has been confined to ordinary operation where the output is continuous, particularly when the tube that does the job, magnet and all is no bigger than a five hundred watt tube built for lower frequencies. The explanation is the fact that with pulsing the tube in the non-operating position a far greater part of the time than it is working; the "duty cycle" is such that the tube is "off" more than a thousand times longer than it is "ON". But the capacity to produce the power must be there, nevertheless; the only "saving" is in the fact that the AVERAGE power the anode must dissipate is not large.

SOME MAGNETRON TYPES

It may be of interest to look at some of the characteristics which illustrate the various functions magnetrons were made to perform. One of the more common tubes is the type 2J61A, an eight cavity tunable magnetron capable of delivering peak power of a hundred kilowatts over a range of 3000-31000 megacycles when operated at 14 kilovolts. The magnet field necessary for its operation is about 17 hundred gauss.

An example of a light weight low powered tube is the type 2J39. The 2J39 is an integral magnet 10 centi metre oscillator weighing less than two pounds and is capable of delivering nine kilowatts when pulsed at five kilovolts.

A tube which is fairly representative of the high powered class of magnetrons is the type 4J31. This tube delivers 1,000,000 watts (that's right—Ed.) when operated at 30,000 volts and 70 amps. Provided sufficiently antenna is used, enormous ranges can be scanned with a radar build with such a high powered tube.

The type 3J55 represents the ultimate to-day in the design of a three centimetre magnetron. This tube which operates at 9375 megacycles is a package type magentron having an integral magnet. Its overall weight including magnet is a bit over two pounds. At 12 kilovolts and 12 amperes the 2J55 delivers 50 kilowatts of peak power.

The super high frequency radar required several types of special micro-wave tubes other than magnetrons. Of considerable interest are the velocity modulated types such as the 707 and the 2K28 at ten centimetres, and the 2K25 at three centimetres. These tubes are used as local oscillators in superheterodyne receivers. Their operation is essentially the same as that of a common toy whistle. In a whistle a stream of air is blown past a resontaing chamber, and if the air velocity is correct a sound whose pitch is determined by the volume of the resonator will be produced. In velocity modulated oscillators a stream of electrons is shot out of a gun through a small cavity resonator. By properly designing the cavity and by controlling the speed of the electron Stream, oscillatons are produced having a frequency determined by the constants of the resonator cavity. The 2K28, a common type of such tube, puts out an average power of 150 milliwatts at 10 centimetres with the resonator held at 300 volts. Such a tube readily can be frequency modulated and it may be of considerable interest to the Ham who wants to experiment with short range directional communication at low power.

NEW TUBES

Although not available in this country, the design data of two new tubes, the HD59 and 2E25 is published for the interest of readers. The tubes are products of the Hytron Radio and Electronics Corporation, Salem, Mass., U.S.A.

HYTRON DEVELOPMENT TYPE HD59
Miniature Instant-Heating Beam Tetrode.

The Hytone development type HD59 is a filamentary type of beam tetrode designed for use in higher frequency mobile equipment as an audio frequency amplifier, Class C oscillator ,and frequency multiplier in those applications where it is desired to eliminate filament drain during standby periods. The oxide coated filament of the HD59 comes to operating temperature in less than one second.

GENERAL CHARACTERISTICS.

Filament	Oxide coated
Potential a-c or d-c	6.0± 10% volts*
Current	0.7 amperes
Transconductance	3000 umhos
Amplification factor (average)	70
Plate resistance	27,000 ohms
Direct interelectrode capacitances (without external shield)—	
Grid to plate (maximum)	0.3 uuf
Input	10.0 uuf
Output	7.0 uuf
Maximum overall length	2⅝ inches
Maximum diameter	¾ inch
Seated hold-down height	2±3/32 inhes
Bulb	T5½
Base	Miniature button 7-pin
Mounting position	Filament plane must be vertical

Beam plates should be connected directly to ground. In V.H.F. cidcuits the filament leads and center-tap should be by-passed to or grounded to a common point to provide lowest effective filament inductance.

A.F. POWER AMPLIFIER—CLASS A1

Maximum Ratings, Design-Centre Values.

D.C. plate potential	250 max. volts
D.C. screen grid potential	250 max. volts
D.C. plate input power*	7.5 max. watts
D.C. screen grid input power	1.5 max. watts
Plate dissipation	7.5 watts

Typical Operation—Average Characteristics

A.C. filament potential	6.0 volts
D.C. plate potential	250 volts
D.C. screen grid potential	250 volts
D.C. control grid potential§	(a) —20 volts (b) —— (c) 450 ohms
Peak a-f control grid potential	20 volts
Zero signal d-c plate current	40 ma
Max. signal d-c plate current	42 ma
Zero signal d-c screen grid current	2.5 ma
Load resistance	4500 ohms
Max. signal plate power output	3.5 watts

R.F. POWER AMPLIFIER AND OSCILLATOR CLASS C TELEGRAPHY AND FREQUENCY MODULATION

Key down conditions per tube without amplitude modulation.

Maximum Ratings, Absolute Values

D.C. plate potential	250 max. volts
D.C. screen grid potential	180 max. volts
D.C. control grid potential	—150 max volts
D.C. plate current	50 max. ma
D.C. control grid current	3 max. ma
D.C. plate input power	12.5 max. watts
D.C. screen grid input power	1.5 max. watts
Plate dissipation	7.5 max. watts

Typical Operation—Class C Oscillator—Average Characteristics—

D.C. plate potential	250 volts
D.C. screen grid potential	150 volts
D.C. control grid potential§	(a) —75 volts (b) 2700 ohms (c) 1500 ohms
Peak r-f control grid potential	100 volts
D.C. plate current	37 ma
D.C. screen grid current	9 ma
D.C. control grid current	2.8 ma
Control grid driving power	.35 approx. watts
Plate power output	6.0 approx. watts

Class C Doubler—(40 to 80 mC).

D.C. plate potential	250 volts
D.C. screen grid potential	150 volts
D.C. control grid potential	—150 volts
Peak r-f control grid potential	175 volts
D.C. plate current	39 ma
D.C. screen grid current	7 ma
D.C. control grid current	3 ma
Control grid driving power	0.55 approx. watts
Plate power output	4 approx. watts

NOTE:

* Switching of the filament with plate and screen potentials applied may result in damage to the HD59. Circuits should be designed to remove high voltage prior to or simultaneously with the filament voltage.

§ Obtained from (a) fixed supply, (b) control grid resistor, (c) cathode resistor, or by combination of methods.

HYTRON 2E25

(Tentative Data)

The 2E25 is a 15 watt tetrode with an instant heating filament for use in r-f and modulator service. In portable and mobile applications, the filament can be shut off

during standby periods with tremendous saving in battery drain, as compared to cathode type tubes when transmitting time is a small percentage of the total time. Under these conditions, the plate supply must be turned off before or simultaneously with the filament. When heated from a transformer with a normal 6.3 volt output the connections may be made with small wire in order to introduce a potential drop of 0.3 volts. This tube requires no neutralization up to frequencies of 100 megacycles and can be used at full ratings to that frequency.

GENERAL CHARACTERISTICS.

Filament	Thoriated Tungsten
Voltage a-c or d-c	6.0± 5% volts
Current	0.8 amperes
Transconductance	2500 umhos
Amplification factor (average) (G_1 to G_2)	6
Direct interelectrode capacitaices—	
Grid to plate (maximum)	0.15 uuf
Input	8.5 uuf
Output	6.O uuf
Maximum overall length	4-3/16 inches
Maximum diameter	1-7/16 inches
Bulb	ST-11
Cap	Small metal
Base	7-pin medium shell short octal phenolic
Mounting position	Filament plane must be vertical

A.F. POWER AMPLIFIER AND MODULATOR CLASS A1

Maximum Ratings, Design-Center Values

D.C. plate potential	400 max. volts
D.C. Screen grid potential	250 max. volts
D.C. plate input power*	10.5 max. watts
D.C. screen grid input power	2.5 max. watts
Plate dissipation*	10.5 max. watts

Typical Operation—Average Characteristics

A.C. filament potential**		6.0	6.0 volts
D.C. plate potential		300	250 volts
D.C. screen grid potential		250	250 volts
D.C. control grid potential**§	(a)	—25	—22.5 volts
	(b)	——	——
	(c)	600	500 ohms
Peak a-f control grid potential		25	22.5 volts
Zero signal d-c plate current		34.5	38.5 ma
Max. signal d-c plate current		37	40 ma
Zero signal d-c screen grid current		3	4 ma
Max. signal d-c screen grid current		8.4	9.6 ma
Load resistance		7000	6000 ohms
Total harmonic distortion		11	7 per cent.
Max. signal plate power output		6	4½ watts

A.F. POWER AMPLIFIER—Class AB2

Maximum Ratings, Absolute Values

D.C. plate potential	450 max. volts
D.C. screen grid potential	250 max. volts
Peak positive a-f control grid potential	60 max. volts
Max signal d-c plate current§§	75 max. ma
Max signal plate input power§§	33 max watts
Max signal screen input power§§	5 max. watts
Plate dissipation§§	15 max. watts

Typical Operation—Average Characteristics

Unless otherwise specified, values are for two tubes

A.C. filament potential**	6.0 volts
D.C. plate potential	450 volts
D.C. screen grid potential	250 volts
D.C. control grid potential **§ (a)	—30 volts
Peak a-f control grid to control grid potential	142 volts
Zero signal d-c plate current	44 ma
Max. signal d-c plate current	150 ma

(Continued on Page 22)

IN REVIEW

TECHNICAL BOOKS - - - - - - - RECORDINGS - - - - - - - - - - - - PRODUCTS

BOOKS

PRINCIPLES OF RADIO FOR OPERATORS

Ralph Atherton.

This book was apparently produced by Professor Atherton to be used in the course of a training programme for Navy operators at Miami University. The complete course took 16 weeks and the book is set out on a chapter a week basis.

The need for such text books as this has, of course, now passed, but it is to be hoped that this one and a few others remain in print, as their usefulness for the training of candidates for civilian operator's certificates is readily apparent.

This is an elementary book, and it would not serve as a complete guide to the study necessary for the A.O.C.P. examinations, but in conjunction with the generally accepted "standards" manuals it may be very helpful to the student.

The first part of the book treats the nature of electric currents, batteries, Ohm's Law, simple circuits, magnetism, inductance, capacitance, and alternating currents. The aplication of these basic principles to the operation of radio is pointed out as they are introduced. The remainder of the book deals directly with radio—sound and sound waves, vacuum tubes, power supplies, receivers, transmitters, antennas and their operation and maintenance.

The only query one might raise in connection with this book concerns the title—it would seem to pander to the old idea, more prevalent in the Services than elsewhere, that an operator is one who can send and receive like a machine under all sorts of difficult conditions, but who need not know much about his equipment. Nothing could be more fallacious. Let us hope that the disturbing tendency in that direction noticeable in the U.S.A. in the immediate pre-war years, due very largely to the ready availability of factory made transmitters and other gear, will not manifest itself in Australia.

PRINCIPLES OF RADIO FOR OPERATORS—Ralph Atherton (Macmillan, N.Y. 1945) 331 pages 5 x 7 and index, 426 diagrams, 23/6)

U.H.F. RADIO SIMPLIFIED—Milton S. Kives.

There seems to be a certain amount of competition these days among technical writers to see who can present U.H.F. technique in the simplest form. At first sight it was thought that Milton S. was an entrant in the race, but perusal of his book shows that he has not been rash enough to sacrifice usefulness for over-simplification in the presentation of his subject.

While it is true that Maxwell's equations and Fourier's Analysis are not to be found in this book (these two gentlemen have been well and truly immortalised elsewhere, anyhow!) sufficient matter are included to help out.

The arrangement of the text is logical and orderly, following an introductory chapter which sets out the fundamental differences between H.F. and U.H.F., Magnetrons and Klystrons are dealt with. Having, as it were, penerated sufficient U.H.F., the author passes to a discussion of Transmission Lines, Wave Guides, Resonators and U.H.F Antennas. Chapters on U.H.F. Measurements and Wave Propagation are used to complete the review of the subject. The treatment of wave propagation is particularly good.

Useful both for the beginner and the established amateur who is about to make his first attack on the U.H.F.'s and for that matter the V.H.F.'s.

U.H.F. RADIO SIMPLIFIED—Milton S. Kives (Van Nostrand, N.Y. 1945) 235 pages, 5 x 7 and index, 157 illustrations, 26/-).

OUR FRONT COVER

—AN INTERESTING MEASURING INSTRUMENT

The Philoscope Type T.A. 160, now available to "Hams" is an extremely versatile measuring instrument manufactured by Philips Electrical Industries.

Constructed around the well known A.C. bridge principle the instrument includes built in standards for measuring a wide range of impedance values. Instead of the usual phones or delicate meters for balancing the bridge however, it makes use of a sensitive "magic eye" indicator. This gives an accurate sharp null completely unaffected by vibration or shock. Use of the magic eye also has permitted the incorporation of a variable sensitivity control by means of which the response at balance can be broadened to any desired degree when searching for the approximate value of the impedance being measured.

The measuring range covers 0.01 ohm to 10 megohms on resistance and 10 M.M.F. to 10 M.F. on capacity ranges. In addition, the Philoscope can be used for external comparative measurements of resistance, capacitance or inductance either as a ratio over a range of 0.1 to 10 or as a close percentage of —20% to + 25%. All measurements are read directly from the main dial and range switch. Accuracy on all ranges is ± 5% and provision is made for checking calibration at any time.

The instrument is completely self contained and is mains operated by a 220, 240, 260 volt + 10%, 50 cycles supply. The maximum voltage applied to components under test is 3 volts or in the case of a low resistance the maximum current is 500 m.A. so that there is no danger of damage to components by incorrect connection.

The next few months will show much rebuilding and experimental work in amateur circles. Without adequate test gear however, efficient construction and adjustment of radio equipment is impossible. When it comes to checking circuit impedance values the T.A. 160 Philoscope is outstanding. Everything from oscillator grid resistors or high tension filter condensers to the station earth resistance may be accurately and quickly tested with this compact and robust instrument.

RECTIFIERS.

easil be done with small resistors in series with each anode. As only two or three volts drop are needed, the ohmage is low and the effect on output voltage and efficiency is negligible.

The automobile type of rectifiers and those used in A.C./D.C. equipment have the cathode insulated from the heater. Actually all heaters are insulated by a coating of pure sintered alundum, baked at temperatures higher than normal. In the case of these rectifiers there is a large voltage between heater and cathode which calls for special care and testing. Life tests are made under very stringent conditions which maintain a large voltage between heater and cathode. In the field the insulation leakage is not likely to amount to more than a few micro-amps.

In the absence of actual breaking away of the alundum permitting the heater to touch the cathode, no trouble need be feared. Such breakdowns are not common, but it is obviously good practice to insert a protective fuse. This should be done with indirectly heated rectifiers for another reason; because of the low impedance in the event of a short somewhere else in the equipment the current may rise enough to damage the cathode or to burn out its pigtail connection and the fuse will prevent this untimely decease of the rectifier.

FEDERAL HEADQUARTERS

HANDBOOK.—The long awaited "Handbook for the Guidance of Operators of Experimental Wireless Stations," is now available from offices of the Wireless Branch in each State, price 1/6. Every Ham and intending Ham should have one.

CALENDAR.—We have just received the I.A.R.U. Calendar for December, 1945, and this month we are devoting the remainder of our space in these notes to extracts from it.

"This Calendar, the first since December, 1941, goes to a Union membership struggling to reconstitute itself after the effects of nearly six years of war. We should like to be able to report a complete return to normal, but unfortunately we cannot. Conditions in our various countries are widely different. In some, where the member-society has been fortunate enough to continue operations during the war period, activities and enthusiasm are reaching all-time highs. In several countries where organizational activities were suspended or existed only on a skeleton basis, officers and key personnel are still engaged in rapidly guiding their societies back to peace-time status. From some countries, of couse, there is no word of any kind.

As a means of informing each of us about the individual situations of the others, we list below a brief summary of conditions in the countries from which we have recent reports, the latest received to the date of this Calendar

Argentina.—Back on all pre-war bands. Society very active during wartime, amateurs being permitted to operate on 5— and 2½ metres.

Australia.—Impounded apparatus being returned, and new regulations being drafted. Society maintained skeleton activity during wartime.

Belgium.—Amateur licenses cancelled and ownership of equipment still prohibited, but much hope is held for eventual restoration of ham radio. Status of F.E.B. uncertain, but both French and Flemish-speaking societies still active.

Brazil.—Back on all pre-war bands. Society very active

Burma. No word.

Canada.—Back on bands above 28 Mc. (See United States)

Colombia.—Back on. Society active.

Cuba.—Back on all bands, subject to issuance of new licences. Society active.

Czechoslovakia.—No word on reactivation, but society resuming activity.

Denmark.—No amateur operation, but society active.

Egypt.—Believed back on air, but no word from the society

Eire.—Society has resumed activity, negotiating the return of impounded gear. No amateur authorization yet.

Estonia.—No word.

Finland.—Society resuming activity, but no authorization for amateur operation as yet.

France.— Society maintained activities underground during wartime; now being reorganised. Amateur operation not yet authorized.

Germany.—No word. Amateur radio of course prohibited.

Great Britain.—Society very active. Amateurs being reactivated on 28 Mc. and above under new regulations

Hungary.—No word.

Italy.—Some society activity, but no amateur operation.

Japan.—No word. Amateur radio of course prohibited.

Lithuania.—No word.

Luxemburg.—Society suffered greatly during war; now resuming activities. No amateur operation.

Manchukuo. No word

Mexico.—Back on all bands. Society very active.

Netherlands.—No amateur operation. One new association formed to absorb several previous ones, including our member-society.

Netherlands Indies.—No word

Newfoundland.—Back on all bands. Society active.

New Zealand.—Society active, awaiting authorization for amateur operation.

Norway.—Society active. No amateur operation.

Poland.—Society reported disbanded, headquarters destroyed. No amateur operation.

Portugal.—No word.

Rumania.—No word.

South Agrica.—Society again active. No amateur authorization as yet.

Spain.—No word.

Sweden.—Society resuming activity. No word on amateur authorization

Switzerland.—Back on all pre-war bands. Society very active.

United States.—Society very active. Amateur operation authorized on 28 Mc. and above.

Uruguay.—No word.

Venezuela.—No word.

There are many administrative membership problems facing the headquarters. Will there again be a society in Germany or Japan able to qualify under the Union's constitution? What is the official political status of Manchukuo? What is the status of the Axis "satellite" countries in Europe? What is the status of certain occupied countries which may be annexed or absorbed into others? The Headquarters finds itself unable to answer these and other comprehensive questions and feels that only the passage of time and future decisions of the United Nations Organization will it be possible to attain a solution.

Further, it is easily apparent from the above tabulation of activity that there are disrupted conditions in many of our member-societies, so that it will be impossible to conduct successfully even the normal, routine business of the Union. The Headquarters therefore feels obliged to announce that it is unable to transact business within the Union, including the acceptance of formal Proposals requiring voting, until such time as a reasonable majority of member-societies are found to be currently active and able to participate in the Union's affairs. This Calendar will remain purely informative temporarily, its prime purpose being to facilitate the reactivation of our member-societies and provide a common working ground for our objectives.

One of the most important tasks of our Union is to prepare now for the next world conference on radio, expected in late 1946 or early 1947. Nearly ten years have elapsed since the last one in Cairo, 1938. During that time radio technique had made many strides forward, resulting in new and expanded services and consequently greatly increased pressure for frequency assignments Because of the widespread political changes which have occurred as well, the next conference will not only revise the Cairo regulations but also the Madrid convention of 1932. It will therefore be an event of great import to us all.

A preparatory five-power meeting between China, France, U.S.S.R., the United Kingdom and the United States is planned to be held during March or April, 1946, in or near Washington, D.C. This meeting will act as a "steering committee," not only setting the actual time and place for a world conference but also attempting to come to preliminary arrangement on various matters which will certainly be brought up at the international conference itself. We shall have further information for the June Calendar.

For the information of members the Headquarters reports that the U.S.A. has already prepared its position for the coming world conference, providing for retention of the customary amateur bands between 3500 and 30,000 kc. (except that in the U.S the 10-metre band is provided as 28,000-29, 700 kc.; it is hoped the full width will be available in other countries). The United States proposal has been agreed to, in substance, by the nations represented at the recent Inter-American Radio Conference at Rio de Janeiro. At that conference also it seemed the sentiment that our 160-metre band would be henceforth assigned in the American region for navigational aids and no amateur facilities would be available below 3500 kc.; however, it is hoped that in countries outside the Americas where low frequencies may have useful amateur application, the band may be retained

The Headquarters particularly wants to call attention to a proposal that will be advanced at the proper time by the U.S.A., to allocate the amateurs a new band of frequencies 21,000-21,500 kc. Although only of marginal value commercially because of changing propagation characteristics and therefore not heavily occupied, these channels should be of great value to amateur radio. It will surely be well worth our while to exert our greatest efforts to secure this new band of frequencies. The location is good, being the third harmonic of 7 Mc. The Headquarters suggests that member-societies take such action as seems appropriate in mentioning the matter to their respective governments and endeavour to arrange for their approval of the proposal when it is put forward by the United States.

The member-societies of the Union have a great responsibility in the cementing of relations with government authorities, keeping our world-wide position as strong as is possible. It should be remembered that no matter how firmly entrenched amateur radio may be in several of the larger countries, it is the **combined** vote of all nations, large and small, which produces the final frequency allocations and regulations. The underlying theme of all our work over the next year must be the preparation for the coming world conference.

CORRESPONDENCE

Correspondents are requested to keep their letters short and to the point. The Editor reserves the right to delete anything he may think fit. The views expressed by correspondents are not necessarily those of the proprietors.

C/o B.B.C.A.U.,
Labuan Island, North Borneo.

The Editor—

I wish to bring to your notice that this station, VS5 JH, is temporarily off the air, having had authority to operate withdrawn.

I wish to thank those members who reported on my signals, actually I have received numerous SWL reports from all over the world

Until I ceased transmission I had WAC on 14 mC CW and worked just under 50 countries, so I am quite satisfied with the results. Of course, the transmitter here was using 200 watts so one should certainly put out a good signal. The line up was as follows—807 c.o. (tritet), 807 buffer-doubler, parallel 813's. The antenna was a delta matched dipole about 60 feet high, and the receiver an R.C.A. AR88

Ten metres seems to be quite good up here, although few U.S. stations have been heard, numerous Ws on service in the Pacific area are active and put in an R9 signal.

I am awaiting permission to operate on Ten, but can only manage about ten watts.

In conclusion, let me wish the W.I.A. the best of luck for the new year and hope that 1946 will see us back on all bands.—Yours, etc.,

CPL. JOHN A. HUNT, VS5JH

DIVISIONAL NOTES

NEW SOUTH WALES

The January Meeting of the Division was held in the Main Hall, Science House on Friday, 25th January. The attendance was a record one, 130 members being present. It had been anticipated that upon obtaining more accommodation the seating problem would have been overcome, but quite a few people had to stand. Sorry, chaps, looks as though we'll have to take the Town Hall soon.

This Meeting had been set down as the 36th Annual General Meeting, but several irregularities were pointed out, and it was found that it could not be held as such. The Annual General Meeting will be held in April.

The Chairman in declaring the meeting open, extended a welcome to Arthur Middleton, VQ2MI, Hank Koehler, VE4RL, and Earl Earle Williams, VK4ALE. Special welcome was extended to Bill Moore, VK2HZ, Jim Edwards, 2AKE, and Gordon Brigden, 2ACJ, who were until recently P.O.W.'s.

A very interesting lecture was given by Dr. Bowen, Deputy Chief of Radio Physics Laboratory. The speaker had chosen for his subject "The Development of Radar," and the lecture was supplemented by moving pictures and lantern slides, Dr. Bowen being asisted in this respect by our old friend, "Bill" Stubbs, of the Australian Amateur Cine Society. It goes without saying that this was one of the most interesting talks ever given at an Institute meeting. The meeting expressed its aproval in a very enthusiastic manner.

Members were informed that the Australian Radio Propagation Committee intended making available to Amateurs, Monthly Bulletins setting out the Frequency to be used for any distance any time of the day. This information had been of untold value during the war to the Services, of course—and it is anticipated that the information would be of great value to Experimenters, with particular reference to the 50-54 mc. band.

With so much business to be transacted with reference to the forthcoming Convention to be held in Melbourne over Easter, General Meetings will be held as usual on the fourth Friday in the month, but in addition another night has been set aside for the Lecture. Thus in February the General Meeting will be held on the 22nd and on the 25th . F. P. Wood, B.Sc., Secretary to the Australian Radio Propagation Committee and Senior Research Officer, Radio Physics Board will lecture on "The Ionosphere and its Effects of H.F. Communication." At the time of writing it is not possible to give the title of the March lecture.

Quite a large number of VK2 Amateurs have now received their licences and naturally most activity is on "Ten," although we understand that quite a few of the boys are getting ready for "Six." 2LZ, at Wentworth Falls, is putting in a very nice signal here in Sydney on 52.8 mcs. 2WJ, 2ABZ and 2LS are also active.

Remember General Meetings of the Division are held at Science House, Gloucester Street, Sydney, on the Fourth Friday of the Month and all Amateurs are invited to attend.

N.S.W. ANNUAL REUNION

The Annual Dinner and Réunion of the New South Wales Division was held at the New Dungowan on Thursday, 5th February. The Reunion took the form of a Welcome Home to Messrs. Moore, Edwards and Brigden, who until recently were P.O.W.'s. Opportunity was also taken to say farewell to the retiring Superintendent of Wireless, W. T. S. Crawford, Esq.

Sixty members were present and the guests included the Deputy Director of Posts and Telegraphs, Mr. J. Malone, the Acting Superintendent of Wireless, John Wetherill, W. T. S. Crawford, Colonel F. Lorenzo, D.S.O., State Operational Controller, Department of N.E.S. The "Oldtimers" were represented by Joe Reed, Harry Stowe and Malcolm Perry, whilst Phil Renshaw sent his 73's and regretted his inability to attend.

The toast of the "Repatriates" was proposed by Vice-President, Harold Peterson, VK2HP, and each ex-P.O.W said a few words in reply. "Silent Keys" was very nicely and ably proposed by our new Councillor and A.O.C.P. Class Manager, Jack Howes, VK2ABS. This was followed by the P.M.G.'s Department proposed by ex-Federal President, F. P. Dixson, VK2FB Mr. Malone, in reply stretted the value of the Amateur to the community both in war and peace, the happy relations existing between the Institute and the Department. He also made a plea that Australians not to develop an inferiority complex, to be proud of their country and not to make excuses for it. "Guest of Honour, W. T. S. Crawford," was proposed by the Chairman, VK2TI. 2TI briefly covred W.T.S.C.'s fifty years in communications, stressing the fact that Radio in Australia grew up with Mr. Crawford and that he could be looked upon as one of Australia's grand old men of communications. A presentation in the form of a silver tray was then made. "Bill" in reply thanked the Institute and stated that the night's function would be a treasured memory. The toast of the W.I.A. was proposed by Colonel Lorenzo, D.S.O., who stated that he wished to thank publicly the Institute for the splendid work done by the Emergency Comunication Network. The Colonel stated that he was very proud of the fact that Australia, particularly New South Wales, was the only country in the world to have a Radio system linked with an A.R.P. organisation. Therefore he wished to thank the Deputy Controller of Wireless and all operators for their services. "The Press" was proposed by C. S. Higgins, 2LO, and ably responded to by our old friend, John Moyle, VK2JU, Editor of "Radio and Hobbies." "The Visitors" was proposed by Membership Secretary, Bill Dukes, 2WD. VQ2MI responded. The evening concluded with a toast to the chairman.

A good time was had by all. It was very pleasing to see so many old faces again. The "Black Diamonds," who included 2KZ, 2YL, 2MT, 2XT, 2PZ, 2YO travelled 120 miles. That's the real spirit, chaps, and we look forward to seeing you next year. A telegram was received from the Newcastle gang, and letters from Phil Renshaw, Elgar Treharne and Bill Zech.

VICTORIA

The February meeting which was held on the 5th at the Instute Rooms, 191 Queen Street, Melbourne, again demonstrates the increasing interest being taken in Amateur Radio. Membership still increasing in great leaps to such an extent that the new membership secretary, Ray Jones, VK3RJ, says he is "having it." There was a record attendance of 120 members and visitors. Overseas visitors welcomed by the chairman, Harry Kinnear, VK3KN, were GM4NV and ZL4CJ, who are remaining in this country for some time and will be operating VK when licenced.

Recently returned from active service and present at the meeting were P/O Telegraphist Syd Clark, VK3, L/Telegraphist Jack Coulter, VK3MV. The meeting received some great entertainment from some of their experiences (personal, of course), whilst in the Middle and Far East. It was evident that one of M.V.'s experiences caused some embarrassment to VK3EJ whilst on leave in J. It's a good job sailors don't care

Others present a tthe meeting include. VK3's—WY, KN, HX, UJ, EE, BQ, YJ, XD, TU, UJ, AP, SZ, PQ, KC UH, MR, QZ, RJ, UM, LX, YR, HK, IG, EX, MV, CF, MQ, NR, LF, ST, JI, ZT, OJ, GN, FJ, OZ, OC, WG, NU,

TQ, RI, PO, PU, WQ, ZC, MO, CR, CO, XJ, RN, IK, ML, BD, EK, ZG, DM, CT, JO, AG, IF, NW, QU, ED, MJ, JD, JD, SO, EV, IU, AJE, XA, TZ, XZ, TF, LA, QS, BS, HS, NY, VQ, DA, QN, FU, 3JT, AT, SB.

I. G. Groves, A. R. Herald, H. M. Walsh, A. Patterson, H. Waterman, S. I. House, D. W. Fryer, A. B. Bunney, H. C. Seddon, G. M. A. Lahiff, K. Maroney, J. P. Lancaster, H. W. Oakes, J. Kirley, C. Arnold, W. A. Shaw, D. Kerr, L. Shurrier, J. Bail, S. J. Chesterfield, S. T. Clark, G. W. Neilson, P. J. Pollock, J. C. Belcher, J. S. Taylor, A. Knight, I. Burns, A. G. Smith, J. W. Hall.

We are pleased to announce the following new members:—T. P. Kirby, 3KI; H. J. W. Hall; R. G. Coppen, 3NU, F. L. Johnson; D. L. Coghlan, 3ST; H. H. McLeod; J. W. Emmel, 3AJE; G. W. Neilson; H. Jupp, ZL4CJ; R. J. Bollock; F. C. Kerr, 3EK; N. L. Storck, T. E. Mablestone, 3QN; W. H. Tetheradge; W. T. S. Mitchell, 3UM; A. E. Henry; W. H. Fleming, 3HP; E. C. Barry; A. J. E. Shields, 3GP; A. R. Lee; L. B. Fisher.

In the course of general business, 3YP's motion of previous meeting concerning allotment of frequencies or divisions on 28 m/c band was clarified when he said: "He was speaking from the CW man's point of view. The suggestion is that 28 to 28.2 m/c be used by CW stations only, the remainder of the band for fone operation. During the discussion, Bill Gronow, 3WG, suggested "What about some letters in the magazine, short, hot sweet on this highly contentious matter. So, fellows, the tin is in the middle of the field. Anybody having a kick?"

Interesting discussion centred around the different types of service equipment which would be disposed of soon, and in this regard there was to be some consideration for members in the country who were more out of touch with Disposal Commission activities.

The Institute had taken the initiative and a scheme will be in operation for purchase of certain types of transmitters and receivers by tender. Country members are hereby advised to contact the Hon. Secretary for further information should they desire to be in any of the tendering groups, which it is understood will be of great benefit to members of this Institute.

When "Snow" Campbell said that he was unable to listen on the bands and was hungry for information on conditions and activities, quite a number of members came to the fore. Max Howden, 3BQ, explained some conditions on 28 m/cs. As yet no good, it was stated the alternate day cycle was working. Some W's on CW in mornings, evenings a few Europeans D4 U.S.A., etc. The conditions were the same in 1934 period and anyway there were lots more stations starting up on 28 m/c band. It was reported by VK3EE that he and VK3BQ were the first two stations in VK to have a QSO since the closing down of stations owing to war.

The six metre gang still remain at the same numerical strength, and 3MJ offers assistance to others interested in using that band. 3MV and 3TZ reported being active on 112 m/c band and want to know when others are coming down there.

Herb. Stevens, 3JO, reluctantly has to quit some of his activities with the Lab. Committee, but fortunately we can look forward to some assistance from Bill Mitchell, 3UM. Nice work, Bill, and thanks, Herb. Dave Medley, 3MJ, and others promise activity and interest in the work being done by the Laboratory Section.

Bob Anderson, 3WY, thinks it a bad joke to be kept talking on the telephone for long periods at home particularly when there are some good broadcast programmes coming through, or he has something important to do. No offence, fellers, just make your fone operating snappy.

Discussion at Council meeting on 12/2/46 indicates that the Magazine should justify its existence, and the following definition of "Ham-ad." was given. This is a section for Experimenters to advertise, For Sale, Wanted

to Buy or Exchange a personal article. Commercial Ad. Is to advertise gear produced commercially and is for sale, wholesale or retail. The foregoing is as a result of mixing this class of activity with general business at the monthly meeting. So consider the "Mag.", fellows. Why keep a dog and bark yourself?

The March meeting of this Division will be held at the rooms, 6th Floor, Law Courts Chambers, 191 Queen St., Melbourne, at 8 p.m. on 5th. Members, visitors and intending members, all welcome.

QUEENSLAND

The last monthly meeting held on Friday, 25th January, saw a fair roll up, and for the first time for six years the boys were able to boast of the DX they had been working. A committee was appointed to form a students class for theory instruction, under the guidance of Cedric Marley, 4CJ. Others in the committee include 4ES, 4RF, 4HU, 4HB, whilst Eric Neale, 4EN, offered his services as QSL Bureau Officer.

The main business of the forthcoming meeting will be the preparation of agenda items for the Convention to be held at Easter time. A delegate has yet to be selected, but as a couple of city men expect to be in the south at that time no difficulty is expected in this direction.

George Gray, VK4JP, has received a QSL card for VK1DF. If that gentleman cares to contact George, the card can be had for the asking, and George won't be the only one curious about his QTH! The card is from an HB9.

It is with regret that we announce the passing of Mrs. H. Brown, Snr., Mother of Mr. H. Brown, VK3NN, of Yanac. The late Mrs. Brown was well known to many Hams in the old 200 metre days. To Mr. Brown, Snr., and his family we offer our deepest sympathy.

——ADHESIVE TAPE FOR LABELS

Adhesive tape can be effectively used for labels and can be typed on with a typewriter. To do this the tape should be placed lightly and smoothly on a thin sheet of photographic film. This can be easily inserted in a typewriter, and the required details typed on the tape. The tape can now be stripped from the film and applied to the article for which the label has been prepared. To keep the tape clean after it has been applied to the article, it can be given a coat of colourless nail polish.

★

The Western Union Telegraph Company has received permission to build a chain of 22 experimental Class II microwave relay stations extending from New York City to Pittsburgh, Pa. Pittsburgh to Washington D.C., Washington to Philadelphia, Pa. and Philadelphia back to New York City.

The present authorisation is the second link in the continuation of the W.U development programme, the ultimate object of which is to obtain a commercial radio relay system connecting all the principal traffic centres within the United States. Previous grant was made for a chain of similar stations at New York City, New Brunswick, Bordertown and Camden, N.J.

Various frequency bands, extending from 1853 to 11,858 megacycles will be used, with 15 watt power at each station and with types AO, A1 A2, A3, A4 and special emissions.

"Communications."

After general business had been concluded at the last meeting, we had the pleasure of hearing a most interesting lecture by Mr. M. Gabriel, B.Sc., who took for his subject, "The Chemistry of the Atom Bomb," or if you are frightened by the title, "The Atom Bomb in words of one syllable." Those who were present and who absorbed what was explained to them doubtless went away much better informed on the subject. Fred Beech, 4FB, subsequently moved a vote of thanks to the lecturer

Several of the city gang are shortly going to take a fling at the 166-170 Mc band, mainly to serve as a prelude to later operations on lower freq. bands. Among those who will be on are 4RY, 4AW, and 4ZU. Let's hear from onyone else interested, otherwise the band may tend to feel a little lonely' Hi'

The reunion which we had hoped to hold on or about the 8th February, had to be postpuned indefinitely because of booking difficulties. The latest information is that we may be able to hold it obout the 8th March, providing that no hitch arises in the arrangements with Anzac House, which is the probable location of the event. It is also expected that badges will be available by the time that this apears in print Anyone wanting one please forward 4/- to the Secretary, and the badge will be forwarded pronto.

Amongst recent returns to Brisbane and civilian life have been Bill Chitham, 4UU, and Albert Carter, 4LT, both of whom served in the Army, in a radio capacity. 4UU will be remembered as our QSL officer and treasurer before the war. Both of these men are no longer the same as in pre-war years, however, as both have recently taken unto their respective selves a YF. Well, I suppose it eventually happens to even the best of us!

The Institute has decided, following a suggestion by Eric Lake, 4EL, to assist in the building of a transmitter and receiver for one of our number who has recently had the misfortune to almost completely lose his sight. As a result of a World War I injury, Arthur Tonge, recently suffered this misfortune and we feel sure that our efforts in the direction mentioned will be well rewarded.

A little gossip on local activity—4RF, the proud possessor of a very fb receiver which must have taken many man hours of hard work to construct. An exciter of rather flexible design is that recently built by 4AP Alf is using a 6SN7 xtal oscillator, 6V6 doubler and an 807 P.A. It can hardly be called original, but to my mind is as good a line-up as any for 10 and 5 metres.

A rather unique experience recently befell 4FJ, about to be discharged from the Navy. After making an exhaustive survey of the best locations from a ham's point of view, Roy selected on a good spot, ideal for reception and freedom from man-made noises, etc. Also there were no prominent sky-wires in the vicinity. However, there is always a fly in the ointment and in this case it happened to be Bill Petersen, 4FY, who had recently arrived at the same conclusion as 4FJ and was having a house built just across the street.

One of our best Fone signals before the war, 4VJ, has recently started a business of his own. Years of experience with a prominent radio firm here should ensure the success of the new venture. 4 AW is also back in harness getting his business ship-shape again, whilst to go to the other extreme 4FB and 4RY are going on a few weeks' holiday. So you're taking it at last, Fred!

4RC is starting to compile a list of countries worked. Some of these fellows must have been practising, methinks. 4EN recently became so engrossed in a QSO that he didn't notice the time slipping by and was eventually hauled off up to bed by the wife about 1 30 a.m. How do you find the receiver for stability, Eric

Mine stays put in no uncertain fashion

4ZU busy with a power pack for the final, but has a great longing for a few acres of ground so as to permit the erection of a few Rhombics. Is in the position of being able to play around with a couple of Super-Pros and a dozen or so Rhombics at his place of employment, hence the desire expressed above.

4OK, 4CU and others. What's cooking my friends? You must be getting something done, so how about a little dope.

SOUTH AUSTRALIA

There was a record attendance of over 80 at the General Meeting held on Tuesday, 12th February at 17 Waymouth Street. Judging by the amount of chin wagging and rag chewing that went on it would appear that enthusiasm is being maintained at a high level.

An innovation was the issue to members of plaques inscribed with their name, call sign, "handle," etc. These are to be worn at all meetings.

The first item, as is usual here, was a lecture and on this occasion it was given by Mr. Merv. Brown, VK5MB, who took as his subject, "Early Experimenters." This title could mean almost anything. With the lecturer, the emphasis was decidedly on the "Early" as he traced the first mention of "Electrics" to the rubbing of amber with wool as far back as 600 B.C. (before cryst-als). From this point on, rapid progress was made through the centuries until, at the conclusion, we almost reached modern times. Altogether, an interesting and instructive talk, refreshingly off the beaten track.

A vote of thanks to Mr. Brown was proposed by Mr. Warwick Parsons and carried with acclamation.

Items of general business were next attended to and the Federal Convention Agenda also came under discussion.

The President then reported that the Constitution, which had been gone through with a fine tooth comb by Council had now been "vetted" by the Institute's Solicitors and would shortly be put before members. For this purpose a Special General Meeting would have to be called.

Identification cards were issued to financial members who hold a "ticket" which will identify them to the Radio trade, with whom special terms have been arranged for the purchase of gear.

At this stage, Mr. Les. Pearn, VK5PN, moved that members record their apreciation of the Council's efforts to date, adding a rider that it was hoped that the good work would continue. This was seconded by Mr. Doug. Whitburn, VK5BY, and carried unanimously

Mr. Merv. Brown, VK5MB, suggested that a roster be prepared for members to take it in turn to tidy up the room after meetings. Our President welcomed the idea and promptly placed Mr. Brown at the head of the list; also remarking that Council had previously shouldered this burden.

The Institute of Radio Engineers has donated a trophy for competition among our members. Their generous gesture is much appreciated.

Many more VK5's are geting back on the air as their licences arrive and their rigs are completed (if ever a Ham rig is completed) VK5FM reports working eight countries in a row one day. Another active amateur is Bert Brooks, VK5KG, to whom a visit was recently paid. Bert was found hard at work on the rotary antenna, with the XYL taking field strength readings. An unsuspected ant's nest created quite a ticklish situation and interrupted proceedings for a while. However, all in the cause (of course) of science. The transmitter at 5KG uses a 59 tri-tet with 80 metre rock, a 6A6 "double" doubler to 20 and 10 and P.P. 807's in the final. The rig is grid modulated and a dynamic mike is used. The rx is a Three "Toober."

Our membership continues on the up grade and now exceeds 160.

At the next General Meeting to be held on Tuesday, 12th February, at 17 Waymouth Street, Mr. Reg. Davies, VK5LJ, will lecture on "Ten Metres."

TASMANIA

Our monthly meeting was held Wednesday, 6th February under the usual conditions: Council 7.30 p.m. with VK7LJ in the chair; VK7CJ, VK7BJ, VK7ML, VK7CW, and VK7PA. An apology was received from Doctor Kelly, VK7LL.

Correspondence, regulations, convention agenda, QSL Bureau, Social activities, etc., were amongst the business dealt with. Two applications for membership were received and recommended for the general meetings approval.

The General Meeting was started at 8.15 p.m. and present were VK7's GJ, CT, CM, AL, CL; Messrs. F. Gee, A. Morrisby, M. Koglin, J. Moore, as well as Council members mentioned above. Apologies received from Messrs. F. W. Medhurst, A. Russell, O. S. Dahl, J. Waters, E. Nichols and Watson

New members, L. G. Arnold, VK7AM, (full country), and R. S. Allenby (student) were elected unanimously. This brings our present membership to 33 ,consisting of 29 full members and the balance of four in students and associates.

The QSL Bureau is to be reorganised and the job was undertaken by VK7AL, T. A. Allen, and will come into operation as soon as needed. Note address: 6 Thirza Street, Newtown, for the present.

The previous practice of having a G.P.O. Box for official use is to be reverted to as soon as available, but it is understood that at present these are not to be had. (It was suggested we might share one with a love lorn or matrimonial bureau for a little variety).

Prospects of an organised outing were investigated, and the general opinion was in favour of a picnic to commence with as this should promote closer contact for all concerned to have something to which the whole family can be invited, YL, YF, OW, Junior ops and all.

Suitable gear and frequencies are not yet available for a field day, which was the contributing factor for deferring an outing such as this. It was finally arranged to brave the elements in a river steamer to Possum Bay, one of our popular resorts on Sunday, February 24 (Expect a report of this for next issue—Ed.). Suitable gear will be toted along and the day being favourable, all attending should enjoy themselves — French swim suits are barred.

Several items for the coming Convention were discussed and resolutions for the agenda drafted. It is not possible, as yet, to decide as to whether a VK7 Delegate will be present or not, one or two of our members hope to be on the mainland for Easter, but are not yet certain of their business ties. In view of this it may be necessary to elect a proxy.

Further possible locations for a permanent Headquarters for the Division were discussed and are to be enquired into, no activities can be promoted until a suitable place can be procured.

With a display of souvenirs and a talk on his service experiences in lighter vein, VK7CJ brought a very busy evening to an interesting climax "Keeping them on the Air" seemed to be quite a handful at times, most all times, from Terry's very vivid descriptions backed by interjections from others present, who had seen somewhat similar conditions in one or another of the spheres of action.

Additional souvenirs were exhibited by VK7AL in the form of Jap gear to augment those of VK7CJ, and from what one could gleam from the general discussions afterwards it would appar that maybe they will see some further service in their respective shacks before being relegated to the Ham museum.

From VK7AL's experiences with souvenirs, tube filaments didn't appreciate the hard going they were subjected to and had expired by the time they finished their travels, much to his disgust.

Appreiation of VK7CJ's effort was shown in a hearty round of applause when he concluded his reminiscences.

VK7BJ is listed for a talk on Frequency Modulation for the meeting on March 6, and this should interest those who are anxious to try their skill when it is made available for Ham use.

Six VK7 licences are to hand to date VK7GJ, VK7BJ, VK7LL, ex 3LL, VK7CW, VK7LJ, and VK7PA (maybe there are others not known to the W.I.A.), VK7's GJ, LJ, and CW are already in the 28 Mc band. VK7BJ says he has worked VK 2, 3, 4, 5, so far and is looking for further contacts as the band is open quite often at present. VK7GJ is also pretty active using phone, and landed a Yank portable the other day who was operating in Hawaii. Jack says the call sign was quite a mouthful, too. Seems the W's are being heard well here at present from all reports.

VK7BJ is operating CW only says he doesn't feel at all comfortable in front of a mike calling CQ to the four walls. He finds the key much more soothing VK7LJ has set the pace for VK7 by taping the exam. for "A" Class Licence and from the congratulations heard has apparently "cracked it." Whose next?

Many of the new regs. are tough, and a lot of indigestion is anticipated; as if this world hasn't enough trials' Instance—as good as your Xtal might be your neighbours might put you off the air, if you interfere. What recording can I play that will not have entertainment value?—not that I want to play recordings, anyhow.

Watch your studio clock ere you indulge over 30 minutes on that test, no matter how important or maybe you could prepare a "stand in," third party in case of emergency and so save face. Watch your QRM, as a ham I always believed that QRM was one of our heritages and our own worry to overcome Do we need a spoon feeding at this late hour.

Indignant? Why not!

And finally, the Editor must correct a misstatement made in these notes last month. In the description of Bert Russell's antenna reference was made to "7 strand copper insulators." This should read "7 strand copper conductors."

NEW TUBES.

Zero signal d-c screen grid current	10 ma
Max signal d-c screen grid current	40 ma
Max signal d-c control grid current	3 ma
Effective load resistance (plate to plate)	6000 ohms
Max. signal control grid driving power	0.9 watts
Max signal plate power output	40 watts

R.F. POWER AMPLIFIER AND OSCILLATOR—CLASS C TELEGRAHPY AND FREQUENCY MODULATION

Key-down conditions per tube without amplitude modulation.

Maximum Ratings, Absolute Values

D.C. plate potential	450 max. volts
D.C. screen grid potential	250 max. volts
D.C. control grid potential	125 max. volts
D.C. plate current	75 max ma
D.C. control grid current	4.5 max ma
Peak positive r-f control grid potential	60 max volts
D.C. plate input power	33.5 max. watts
D.C. screen grid input power	4 max. watts
Plate dissipation	15 max. watts

Typical Operation—Average Characteristics.

D.C. plate potential		450	450 volts
D.C. screen grid potential		250	250 volts
	(a)	-45	—70 volts
D.C. control grid potential§	(b)	15000	23000 ohms
	(c)	480	750 ohms
Peak r-f control grid potential		90	120 volts
D.C. plate current		75	75 ma
D.C. screen grid current		15	15 ma
D.C. control grid current		3	3 ma
Control grid driving power		0.27	0.36 watts
Plate power input		20	22 watts

PLATE AND SCREEN GRID AMPLITUDE MODULATED R.F. POWER AMPLIFIER CLASS C TELEPHONY

Carrier condition per tube for use with a max modulation percentage of 100.

Maximum Rating, Absolute Values.

D.C. plate potential	400 max. volts
D.C. screen grid potential	250 max volts
D.C. control grid potential	—125 max. volts
D.C. plate current	75 max. ma
D.C. control grid current	4.5 max ma
Peak positive r-f control grid potential	60 max. volts
D.C. plate input power§§§	24 max watts
D.C. screen grid input power§§§	2.7 max. watts
Plate dissipation§§§	10 max watts

Typical Operation, Average Characteristics.

D.C. plate potential	400 volts
D.C. screen grid potential	225 volts
	(a) —70 volts
D.C. control grid potential§	(b) 23000 ohms
	(c) 1000 ohms
Peak r-f control grid potential	110 volts
D.C. plate current	60 ma
D.C. screen grid current	8.5 ma
Screen grid dropping resistor	20000 ohms
D.C. control grid current	3 ma
Control grid driving power	0.33 watts
Plate power output	15 watts

NOTES·

* Class A. dissipation rating based upon tubes having

average plate current. In the case of tubes having maximum acceptable plate current. dissipation will be 15 watts with somewhat higher power output.

** When d-c is used on the filament, the bias should be reduced approximately 3½ volts and the grid return made to negative leg of filament.

§ Obtained from (a) fixed supply, (b) control grid resistor, (c) cathode resistor, or by combination of methods.

§§ Average over any a-f cycle of sine wave form.

§§§ When modulated 100% with a sine wave the average power increase is 5%. With a complex wave form, such as speech o rmusic, the average power increases approximately 20% to 25%.

DIRECT DISC RECORDING.

This means that if we examined the grooves of a Constant Frequency Record whose output level was the same at al frequencies, we would find amplitudes which varied inversely with frequency ,as shown in Figure 3, where it will be readily seen that the amplitude is doubled whenever the frequency is halved.

This is the basis on which commercial gramophone records are made ,and it is brought about by the natural laws of science which are involved in the process of recording and reproducing records. It is known as the Constant Velocity System of Recording. In certain circumstances a deliberate interference to these laws is made by recording engineers in order to produce special characteristics in the recordings, and these will be mentioned later on in this series.

Refering again to Figure 3, however, it will be seen that the amplitudes associated with the lower frequencies tend to become very large, and this leads to com-

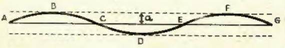


FIG. 1a: 1000-cycle Groove of Amplitude (a).

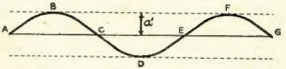


FIG. 1b: 1000-cycle Groove of Amplitude (a').

plications in practice. In the first place we have adjacent grooves pitched at a definite distance apart on a record, and large amplitudes of the type shown will tend to encroach on neighbouring grooves. In addition, such amplitudes would be difficult for normal pickups to negotiate, and there would be a tendency for them to be thrown off on all bass passages. In order to obviate this difficulty, it has been agreed by recordists throughout the world, that the constant-velocity characteristics should be terminated at some frequency where the amplitude has reached a workable maximum, and that below this frequency the amplitude should be maintained constant, as shown by the dotted line. The figure at which this transition is to occur has been agreed upon as about 250 cycles per second, although it tends to vary

slightly among the various recording studios. The range below the transition frequency as aptly named as the Constant-Amplitude Range.

The Constant-Amplitude Range will be deficient in its response because the needle velocity is not being maintained constant. To be exact, we find that this velocity now decreases proportionately to the frequency, or in other words, the energy level is halved every time the frequency is halved. Since needle velocities obey the same laws as alternating currents, we can expres this decrease in energy level in terms of Decibels, and for those who are adept at wrestling with these terms, it will be recognised that each time the frequency is halved, the energy level will fall by about 6 dB.

This deficiency in Bass response is normally not a serious bar to the enjoyment of music produced in a system with this modification on account of the wide accommodating power of the human ear. However when truly accurate reproduction is desired, it is a comparatively simple matter to introduce equalisers into the reproducing system which will retore the overall response to what it would have been without the Constant Amplitude modification. Means whereby this may be done will be discussed in a later article.

STILL MORE IDEAS

We have received several excellent ideas regarding station layouts this month. Perhaps the most interesting of these is one received from Doug. Norman, VK3UC. I think the best thing to do is to quote from Doug's letter. He writes:—

"Dear Editor,—Thinking that you might be interested in the ideas of yet another Ham, here's a sketch of the set up I'm planning for myself at the moment.

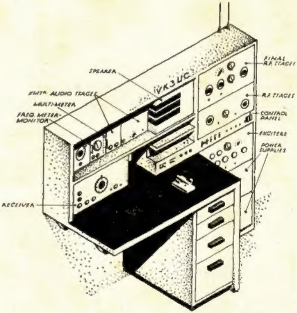
The arrangement is a combination desk and transmitter rack, all individual sections of the gear being removable—including the speaker box and the front panel. This control panel, incidently, is to include all mains switching, fusing, high tension switching and indicator lights—and, of course, send receive switches, aerial relay controls and what have you. The layout of controls, switches, etc., shown in the sketch is not final yet, but is merely included for the sake of completeness. However, it is hoped that the final layout will be pretty much as sketched.

Further rack space suitable for other power supplies or so, is to be provided behind the top two drawers of the desk.

I intend to finish up with crystal control and a pretty good E.C.O. exiter unit for 80, 40 and 20 driving a TZ20, which will eventually act as a driver for a possible 100 watter.

"Something in the V.H.F. line" will be added later, as will the speech amplifier and modulator gear, and anything else I hapen to get started on.

Incidently, the spaces above the desk section of the control panel are for log, Q.S.L.'s and similar junk."



FOR SALE — EXCHANGE — WANTED

9d. per line, minimum 2/-

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This column is for your use.

Why not take advantage of it?